BACKGROUND

Prior to the development of Applicants' claimed printed wiring boards, aqueous through hole coating compositions containing nonmetallic, electrically conductive particles were developed to avoid the expense and disposal problems associated with direct deposition of metal on a nonconductive surface or the use of nonaqueous solvents. A prior art conductive coating process employing an aqueous dispersion of carbon black is commercially available under the BLACKHOLE trademark. It is difficult to make the BLACKHOLE process work, however, and it provides a coating with an undesirably high electrical resistance. The disadvantages of employing a coating having a high electrical resistance are described in Applicants' U.S. Patent No. 5,725,807, at col. 4, lines 4-16, which patent has been expressly incorporated by reference in the present specification, at paragraph 1. The BLACKHOLE process is essentially the same process disclosed in the Minten reference cited by the Examiner and discussed further below.

The electrical resistivity problem with the carbon black process has been addressed commercially in the BLACKHOLE process by depositing a second coat of carbon black over the first to lower the resistivity of the coating. The Randolph reference cited by the Examiner also addresses the high resistivity of the carbon black process by depositing a second layer of graphite over a first layer of carbon black. These two-pass processes require more materials, time, and equipment than a one-pass process.

The initially nonconductive through holes or other recesses of the printed wiring boards according to the present technology are made electrically conductive by providing a single-pass coating containing, in addition to graphite and/or carbon black, an organic, water-dispersible binding agent. The coating can be formulated and applied to be very thin and to have much lower resistivity than prior water-based carbon black compositions, such as the BLACKHOLE process disclosed in

the Minten patent. The organic, water-dispersible binders used in the present coating formulation allow the carbon coating to adhere far better to the nonconductive surfaces of the through holes than the prior water-based carbon compositions when the board is subsequently subjected to electroplating and the thermal and mechanical stress of soldering. Obtaining adequate adhesion of graphite coatings to nonconductive substrates has been a long-standing, well-recognized problem in the printed wiring board art. *See, e.g.*, the Randolph reference at Col. 4, lines 35-37, as well as the prior art patents disclosed in Applicants' '807 patent.

Turning now to the references forming the basis for the Examiner's rejection, Minten discloses applying a carbon black dispersion to the through-holes of a printed wiring board to form a conductive layer in the through holes. Minten teaches that there are three critical ingredients for his carbon black dispersion: 1) carbon black, (2) water or other liquid dispersing medium, and (3) a surfactant. See col. 6, lines 44-48. Nowhere does Minten teach or suggest the use of a water-dispersible organic binding agent as a dispersion ingredient, as required by all of the present claims.

The Randolph patent similarly discloses applying a carbon black dispersion to the through holes of a printed wiring board to form a conductive layer in the through holes. The Randolph patent further discloses applying a graphite dispersion over the carbon black layer to form a graphite conductive layer over the carbon black layer. Both the carbon black and graphite dispersions taught by Randolph contain the same surfactant and water or other liquid dispersing medium as utilized in the Minten reference. Thus, Randolph also does not teach or suggest the use of a water-dispersible organic binding agent. Indeed, the Randolph invention is directed in part to the use of the carbon black layer as an adhesion promoter for the graphite film in order to overcome problems with graphite adhesion. *See,* Randolph '642 patent at Col. 4, lines 40-41.

The Examiner has cited the Yoshida reference as disclosing the coating of carbon using a water-soluble binding agent, and asserts that it would have been obvious to employ such a binding agent in the dispersion used in the Minten printed wiring board to obtain better binding of the carbon.

Yoshida, however, is directed to an electric double layer capacitor having a pair of electrodes composed of <u>electrically-conductive</u> substrates which are coated on both sides with a mixture of activated carbon and a water-soluble binding agent. Yoshida at Col. 2, lines 14-24. The substrates are, for example, plates or foils formed from conductive metals such as aluminum, tantalum and titanium. In the Yoshida examples, the substrates are aluminum foils having a width of 10 mm, a length of 40 mm and a thickness of 20 microns. *See,* Col. 4, lines 3-7. The conductive substrates are coated on both sides with the activated carbon slurry containing the binding agent which is then dried to form the carbon coated electrodes. The electrodes are then wound with a separator interlayed between them, and impregnated with an electrolyte. Nowhere does Yoshida teach or suggest that his carbon coating should or could be used on a <u>nonconductive</u> surface, as claimed in the present claims, or that the carbon coating could adhere to a through hole or other recess having a diameter within the range of about .15 to about 6 mm. Nor does Yoshida teach or suggest how to form a suitable coating that can accept electroplating to form a surface substantially without voids.

"To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim

limitations. *"The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure."* § 2142 Manual of Patent Examining Procedure, 8^{th} ed., Rev. 3 (Aug. 2005) [MPEP], Ch. 2100, p. 134 (emphasis added).

Here, the Examiner has stated that the motivation to utilize the water soluble binding agent of Yoshida in the Minten printed wiring board is to obtain better binding of the carbon. However, Yoshida only teaches applying the carbon layer to a <u>conductive</u> substrate. Thus, there is no teaching or suggestion in the Yoshida reference of applying the carbon layer to a <u>nonconductive</u> substrate, as required by the present claims, or that the binding agent of Yoshida would have any use in binding the carbon to a <u>nonconductive</u> substrate. Absent such a teaching or suggestion, there is no motivation to make the Examiner's proposed modification.

Nor is there any reasonable expectation from Yoshida or any of the other references cited by the Examiner, that the use of a water-dispersible binding agent would have any success in achieving an electroplatable, adherent carbon coating on the nonconductive surfaces of the through holes of a printed wiring board. As detailed in the present specification, at paragraphs 36-42, the water-dispersible binding agent functions in the presently claimed printed wiring board to bind the carbon particles to the <u>nonconductive</u> through holes of the printed wiring board so that the carbon particles form a coating that adheres to the through holes and that can accept electroplating without adhesion failure. Applicants' concept of employing an organic binding agent in the carbon dispersion to bind the carbon particles to the nonconductive substrate is not taught in either of the Minten or Randolph references, and there is certainly no suggestion in either reference that an organic binding would or could be suitable for use in a carbon dispersion for printed wiring board applications.

Yoshida is directed to the preparation of polarized electrodes for a double layer capacitor. Such electrodes are not formed from a nonconductive substrate, do not have through holes or other small diameter recesses to which the carbon coating must adhere, and are not subjected to electroplating. Thus, there is no indication from the Yoshida reference that the water-soluble binders used therein would have any utility in a completely different application, i.e. to provide an electroplatable, adherent coating on the nonconductive through holes of a printed wiring board, as claimed in the present claims.

Accordingly, it is submitted that the Examiner has not established a prima facie case of obviousness because the cited prior art references neither provide the motivation to make the suggested combination nor provide a reasonable expectation of success. Applicants therefore respectfully request that the rejection of the claims under 35 U.S.C. § 103(a) be withdrawn.

With respect to the Examiner's rejection of dependent claims 3-11 reciting different resistivities, and the Examiner's position that the resistivities are process limitations that cannot serve to distinguish product claims over the prior art, this position is respectfully traversed. The claims are directed to a printed wiring board having an electrically conductive carbon coating that can accept electroplating but that is not yet electroplated. As each of dependent claims 3-11 specify, the resistivity is measured <u>before</u> any electroplating takes place, and is therefore a property of the printed wiring board, not a process limitation. Such resistivity measurements of the carbon coated, but not yet electroplated, printed wiring boards are common in the printed wiring board art because they give an indication of the plating speeds that can be expected when the printed wiring boards undergo electroplating. *See, e.g.*, the Randolph '642 patent at Col. 19, Table 2 which provides resistance measurements of treated, but not electroplated boards. See also ¶¶ 90-98 of the present application. Low resistivity is a desirable property of the printed wiring

board because lower resistivities enable faster plating speeds, which can lead to faster and increased production. *See*, ¶ 90 of the present application. Although resistivities of the printed wiring board may have an effect on the subsequent electroplating process, they are still a measured property of the printed wiring board, not a process limitation.

Rejection Based On Obviousness-Type Double Patenting

The Examiner rejected claims 2-19 and 21-22 on the ground of obviousness-type double patenting as being unpatentable over claims 1-19 of U.S. Patent No. 6,710,259. A terminal disclaimer accompanies this response to obviate the Examiner's double patenting rejection.

For all of the above reasons, it is submitted that the claims are patentable over the art of record, and reconsideration of the Examiner's rejections is respectfully requested.

AUTHORIZATION TO CHARGE ADDITIONAL FEES

* The Commissioner is hereby authorized to charge any fees which may be required by this paper and during the pendency of this application to Account No. 13-0017 in the name of McAndrews, Held & Malloy, Ltd.

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Respectfully submitted,

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